PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Sequestration

02/2004

CARBON SEQUESTRATION IN RECLAIMED MINE SOILS OF OHIO

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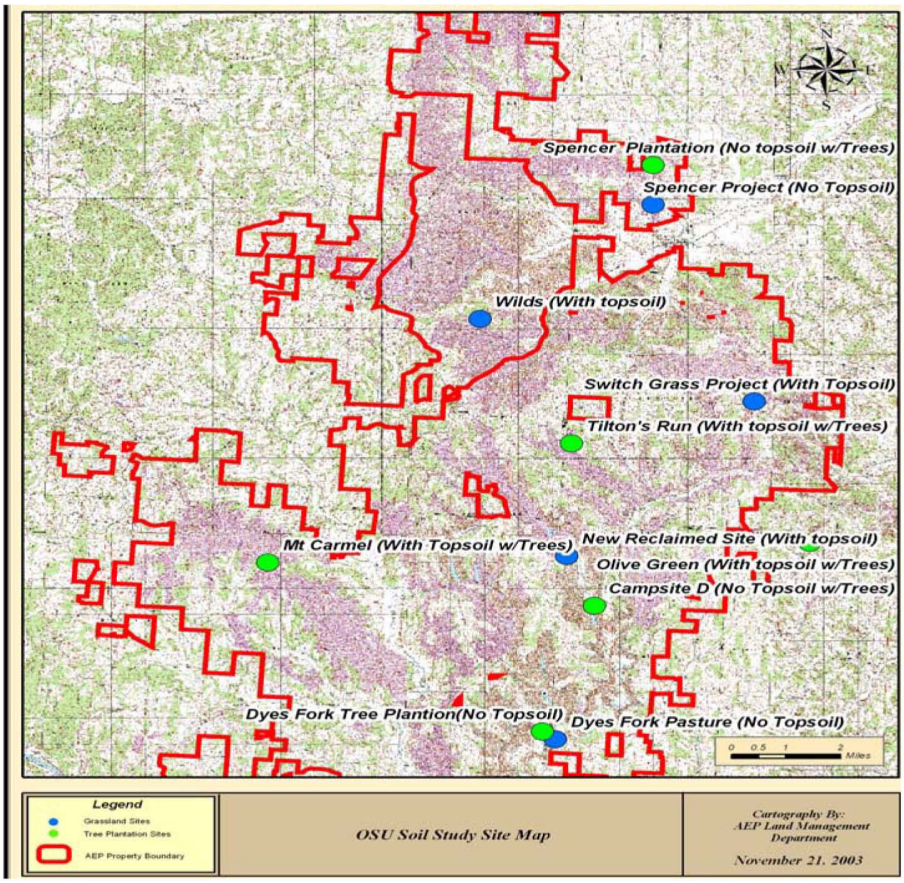
Background

This research proposal is aimed at assessing the soil organic carbon (SOC) sequestration potential of reclaimed mined soils (RMS). Sites mined between 0 and 50 years ago will be identified in regions with similar ecological characteristics. The sites will be carefully selected with similar topography, climate, vegetation, and soil type. These sites will receive six different treatments. At least 50 soil samples will be collected from each treatment and will be analyzed to determine SOC, physical, chemical, and hydrologic properties. The spatial and temporal variations of SOC and the rate of sequestration in forest and pasture will be determined. The mechanisms of SOC sequestration and the potential of biosolids for reclamation will be assessed.

The data gathered will be used to test the following hypotheses: the potential of SOC sequestration in RMS depends on biomass productivity, root development in subsoil, and changes in mine soil properties resulting from the weathering of overburden material; the increase in SOC overtime is related to improvements in soil quality; the capacity of RMS to sequester SOC is a function of the type and duration of land use; the rate of SOC sequestration is related to changes in soil structure; carbon aggregation is influenced by the interaction between SOC and the silt/clay concentration and the mineralogical composition; the rate of SOC sequestration increases linearly with the rate of biosolids application and is proportional to the total amount and rate of release of mineralizable nitrogen; the rate of aggregation dependents upon the mineralizable carbon and nitrogen in the biosolids; and the SOC sequestration potential is related to its mechanical (porosity, strength) and hydrologic (hydraulic conductivity, infiltration rate, available water capacity) properties.

Primary Project Goal

The primary project goal is to assess the degree to which soil carbon sequestration in RMS can offset fossil fuel emissions, provide additional income to land owners through trading carbon credits, and strengthen the terrestrial carbon sequestration data base to assist policy makers on land use modifications to mitigate climate change due to greenhouse gas buildup in the atmosphere.



This map shows the locations of experimental sites

Objectives

- To assess the sink capacity of RMS of various ages to sequester SOC.
- To determine the rate of SOC sequestration and the spatial (vertical and horizontal) and temporal variations of SOC.
- To develop and validate a model for SOC sequestration rate.
- To identify the mechanisms of SOC sequestration in RMS.
- To assess the potential of different methods of soil reclamation to alter SOC sequestration rate, soil development, and soil mechanical and water transmission properties.
- To determine the relation between SOC sequestration rate and soil quality in relation to soil structure and hydrologic properties.

Accomplishments

Test sites, characterized by distinct age chronosequences of reclaimed minesoil, have been selected. The criteria for selection was: (i) reclaimed prior to the 1972 Ohio Mineland Reclamation Act or the 1977 surface mining reclamation and control act (SMRCA) and under continuous grass and forest and without topsoil application, and (ii) reclaimed after the 1972 Ohio Mineland Reclamation Act or, which made application of topsoil mandatory for reclamation, under continuous grass and forest and with topsoil application. Soil samples were collected from 0 to 15 cm and 15 to 30 cm depths and analyzed to determine soil organic carbon (SOC) concentration, total soil nitrogen concentration, pH and electrical conductivity for each sampling location.

CUSTOMER SERVICE

1-800-553-7681

WEBSITE

www.netl.doe.gov

PARTNERS

Ohio State University

COST

Total Project Value:
$706,105

DOE/Non-DOE Share:
$563,491 / $142,614

Benefits

Soils represent a huge potential sink for carbon, and carbon trading could provide the incentive for landowners to modify land management practices to increase carbon sequestration in soils. However, for this to be possible, techniques have to be developed to quantify carbon take-up by soils, and the best treatments to promote carbon accumulation by soils and their associated vegetation need to be determined. This project is addressing both these issues, and its successful completion should yield significant benefits.

Over burden material after topsoil removal

An active mine site reclaimed in year 2003